

# Critical success factors for lean manufacturing implementation in machinery and equipment SMEs

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**ABSTRACT** – SMEs always search for improvement in productivity and quality from their own best way. This paper aims to examine the critical success factors for lean manufacturing (LM) implementation in machinery and equipment small and medium-sized enterprises (SMEs). A survey questionnaire was used in the three case companies that participated. The result revealed that the predominant factors that drive the success of LM implementation in SMEs are employee education training for skills upgrade and top management leadership commitment. This is followed by employee involvement and empowerment, and the development of suitable LM implementation framework which shown equally high critical contributing factors.

## 1. INTRODUCTION

There are a lot of various new challenges faced by manufacturing industry globally nowadays, especially for the machinery and equipment (M&E) small and medium-sized enterprises (SMEs) sectors as compared to other large organizations. Lean manufacturing (LM) is one of the systematic tools which can help SMEs in improving their performances and creating value-added activities with emphasizing waste elimination [1]. SMEs have been adopted many different approaches, but they still find it challenging to implement lean successfully and always lead to poor lean results. Therefore, there is an enormous need for more studies to focus on exploring the prioritization of critical success factors (CSFs) that can enhance the lean adoption and suit explicitly the SMEs' needs and requirements [2-3]. This paper aims to examine the CSFs for LM implementation in M&E SMEs in order to improve the strategy and increase the chances of success in the lean application.

Table 1 Critical success factors for LM in SMEs

Critical Success Factors	[2]	[3]	[4]	[5]	[6]	[7]
Supplier management			X	X		X
Employee involvement		X	X	X	X	X
Customer focus			X			X
Resources (finance, time)	X				X	
Leadership commitment	X	X		X	X	X
Company culture change	X	X		X	X	
Training, skills expertise	X	X	X	X	X	X
Methodology framework		X		X	X	
Effective communication				X		X
Evaluation & measurement				X	X	
Continuous improvement				X	X	X
Teamwork				X		X
Reward and recognition						X

The four predominant CSFs have been identified for this study which shall apply to M&E SMEs from the structured literature review of the previous research conducted (see Table 1) as follows [2-7]:

- 1) Top management leadership and commitment
- 2) Employee training education for skills upgrade
- 3) Employee involvement and empowerment
- 4) Development of the suitable LM implementation framework for SMEs

## 2. METHODOLOGY

A survey questionnaire that consists of four questions is developed for data collection in this study. Two academicians or lecturers from the local public universities who have expertise in this LM relevant field are consulted to review the survey questionnaire. A pilot study was carried out in the selected SMEs to ensure the respondents understand the questions clearly. The comments and feedback are analyzed with those minor modifications made before certified the questions are ready for data collection. Three M&E case companies in Malacca state areas that fulfilled the Malaysian manufacturing SME's definition were selected via a purposive sampling method. Company A is a manufacturing company specialized in the industrial use wire; Company B is focusing on customizing and designing automation machinery in the natural rubber sector. While Company C offering the surface treatment services for aerospace sectors. There was a total of 40 respondents from the executive level and above have participated in this study. The survey questions were established based on a five-point Likert scale to measure the extent of importance level on each identified factor for successful LM implementation in their company with a rating from 0: very low to 5: very high.

## 3. RESULTS AND DISCUSSION

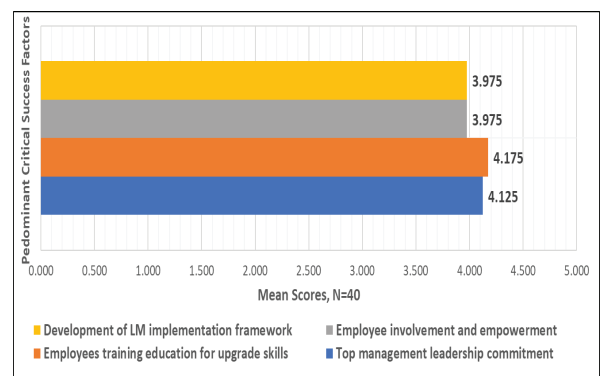


Figure 1 Critical success factors for LM implementation

From the data analysis, it is shown that these four identified CSFs have a highly important impact on the LM implementation in M&E SMEs. The mean scores of the data are within the range of 3.975 to 4.175 (see Figure 1). Employees training and education to upgrade the employee's skills has the highest mean scores of 4.175. This is contrary to the result obtained from Achanga et al. [2], which showed that skill and expertise have the lowest score in comparison. This is followed by the top management leadership and commitment has a second-high mean score of 4.125. This is aligned with Belhadi et al. [3] and Achanga et al. [2], who stated that leadership and management is the most significant factor for successful LM adoption in SMEs. While the LM implementation framework development for SMEs, and employee involvement and empowerment, had an equivalent mean score of 3.975.

The employees need to apply the relevant knowledge and skillset learned in performing the required jobs assigned in LM projects. However, many SMEs recruit people with a low level of expertise [2]. Thus, the intensive lean training assessment matrix shall be conducted regularly by experienced in-house trainers to evaluate the effectiveness of the job completed in problem-solving with analyzed the level of capability and competency among employees. Achanga et al. [2] claimed that strong leadership and management support could enhance the valuable skills and knowledge possessed among the employees. Top managements are the key persons who act as critical decision-makers and provide the right direction in allocating the necessary resources in order to ensure the final LM result can meet the company's strategic objectives. Besides that, top management shall regularly review the effectiveness of the lean management system and communicate the policies throughout the organizations by raising lean awareness. The company should assist their employee in adapting to the smooth transition of LM implementation through the early cultural change in order to mitigate the risks of resistance to change in the workplace.

The higher participation rate of employees can lead to greater chances in the lean strategic objectives fulfillment [4]. Employees who are actively involved in the entire LM implementation process can cultivate the ownership in their respective working stations and encourage them to make a better contribution towards the lean result eventually. Employees should be given the necessary empowerment within the control limits and always take their own initiatives to monitor or analyze the process key performance indicators in the lean project implemented versus the targeted baseline established in order to strive for continuous improvement. Belhadi et al. [3] found that the "understanding, methodology and implementation" of lean is the second important factor in LM adoption, as the misapplication of the lean tools practices and unsuitable application of lean methodology will cause the huge barriers for SMEs [5]. Belhadi and Touriki [6] claimed that none of the existing LM implementation frameworks are perfectly suited to the SME's characteristics. Thus, there is a strong need to develop the comprehensive and systematic LM implementation

framework, which can provide the step-by-step practical guideline as an outline for SMEs.

#### 4. CONCLUSIONS

This paper aims to examine the predominant CSFs, which are essential for M&E SMEs in their LM implementation journey. Lean CSFs in SMEs are highly dependent on soft lean practices or human elements such as leadership management commitment, training and education for upgrade skills, and employee involvement. Moreover, developing a suitable LM implementation framework for SMEs can guide lean organizations in the right direction and provide useful guidance to avoid pitfalls. In a nutshell, M&E SMEs were agreed that these four CSFs are highly influential in the success of LM implementation, and it must be well integrated into the company management system. SMEs still have a high potential to succeed in lean, even though various barriers always exist; thus, a strong emphasis on adopting key CSFs is vital.

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